Andres Cortes
Uppsala University, Sweden
e-mail: aj.cortes235@gmail.com
Fredy Monserrate
Centro Internacional de Agricultura Tropical, Cali, Colombia
Santiago Madriñán
Universidad de los Andes, Bogotá, Colombia
Matthew W. Blair
Centro Internacional de Agricultura Tropical, Cali, Colombia

The Utility of Thornthwaite and Hamon Models for Potential Evotranspiration and Drought Index Calculation: the Case of Wild Common Bean

Potential Evotranspiration (PET) is a theoretical value that aims to characterize the quantity of water that will flux from the soil-biosphere system towards the atmosphere as a consequence of evaporation and transpiration, based on the supposition that available water is infinite. In this research, an agroecological diversity study based on PET was conducted on 104 wild common beans to estimate drought tolerance in their natural habitats. Our wild population samples covered a range of mesic to very dry habitats from Mexico to Argentina. Two PET models which considered the effects of temperature and radiation were coupled with the precipitation regimens for each collection site during the last fifty years. We detected a broader geographic distribution in wild common beans than in cultivated ones. Furthermore, we found that wild accessions were distributed among different precipitation regimens following a latitudinal gradient and that agroecological diversity was structured into natural populations. Habitat drought stress index based on the Thornthwaite potential evotranspiration is the most promising predictor of drought tolerance. This resource should be coupled with considerations about population structure as a consequence of the evolutionary history and diversification process suffered by the species. Finally, this modeling tool suggests that information from wild common bean accessions should be taken into account in order to exploit variation for drought tolerance in order to minimize significant depletion of the yield components.
Key words: Bioclimatic variables, potential evotranspiration models, PET, precipitation, Thornthwaite estimator, Hamon estimator